

Laboratory Lore and Research Practices in the Experimental Analysis of Human Behavior: Selecting Reinforcers and Arranging Contingencies¹

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The choice of reinforcement parameters is a critical problem in the experimental analysis of human behavior in two distinguishable ways. First, unlike non-human subjects who are conveniently maintained in the controlled laboratory environment and are thus always available for research, humans are ranging about the natural environment and special contingencies must be arranged to induce their participation in research. Second, once human subjects arrive in the laboratory, the researcher must arrange contingencies that are effective in controlling the behavior under study. In both cases, the choice of reinforcers has methodological and theoretical implications that remain largely unexamined. For example, we know little about the relative effectiveness of reinforcers used within sessions (e.g., points only, points exchangeable for money, money only) and even less about the reinforcing properties of stimuli used to attract humans to participate as subjects in experimental research (e.g., extra course credit, the chance to win a prize in a lottery, etc.). A description of informal research experiences in tinkering with different reinforcers is thus the logical starting point to explore some important considerations in selecting reinforcers and arranging experimental contingencies.

SOME CONSIDERATIONS IN SELECTING WITHIN-SESSION REINFORCERS

Obviously, the first step in selecting within-session reinforcers involves consideration of relevant subject characteristics. For example, are subjects children or adults, developmentally delayed or "normal"? Normal adults are unlikely to find toys and trinkets reinforcing, and children, especially very young ones, may not have had sufficient experience with money or other tokens for these to function effectively. For these reasons, points exchangeable for money or money itself is often the reinforcer of choice for researchers using adult subjects, while toys or snack items are often used as reinforcers by those using children.

A second important consideration involves subjects' access to particular reinforcers before and during their research participation. Unlike researchers using nonhuman subjects, researchers using human subjects are unable to exert complete control over the reinforcement histories of their subjects (but see Weiner, 1964, 1969). Humans enter the experimental situation with vastly divergent experience with primary and secondary reinforcers, a fact that may partially account for the differences often observed among subjects responding under identical experimental conditions. Nor can we expect to equate motivation across subjects by arranging special experimental contingencies. Although we can be assured that nonhuman animals will show similar behavior under similar conditions while working for food reinforcers

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because they have been food deprived, such arrangements are more difficult to make for obvious practical and ethical reasons when using human subjects.

Children

A perusal of the experimental analysis of human behavior literature found in the *Journal of the Experimental Analysis of Behavior* reveals that tokens exchangeable for toys, trinkets, and the like are the most common reinforcers used with child subjects. A customary practice is to allow children to select a toy or snack from among several alternatives prior to the experimental session and then exchange the points or tokens earned during the session for that toy (e.g., Vaughan, 1985) or snack item (e.g., Lowenkron, 1984). To increase reinforcer effectiveness, researchers often permit children to engage in the experimental task while the toy or snack is in clear view. However, whether or not this procedure actually affects children's performance is an empirical question. It should be noted that usually no rationale for the procedure is provided in the method section of journal reports involving human subjects.

A second practice is to sidestep the exchange process and simply deliver the actual reinforcer as a consequence of responding. In most instances, specific kinds of reinforcers differ from one delivery to the next—different snack items (e.g., Bentall & Lowe, 1987) and different types of reinforcers—soap bubbles, juice, food (e.g., Devany, Hayes, & Nelson, 1986) have been used.

A common problem in working with children is that they tend to fondle or otherwise play with the reinforcer, which may interfere with responding on the experimental task. For example, in one study (Anderson, Buskist, & Miller, 1981), children (ages 5–7 and 9–11) sat before a wooden box with a clown face painted on it. Responses on the clown's nose (a pigeon key transilluminated with red light) produced pennies "spit" through the clown's mouth into a small wooden box according to autoshaping and automaintenance schedules. After pick-

ing up the penny from the box, the younger children would proceed to play with it—tapping it on the clown box, throwing it in the air and catching it (but more often dropping it), putting it into their pockets and then taking it out, or stacking them into piles and then knocking the piles over, etc. Consequently, many of these children failed to attend to experimental stimuli, and "missed" numerous trials. To overcome this problem, Anderson et al. devised a "pennyboard," a square piece of wood containing penny-sized slots, in which subjects were instructed to place their pennies after picking them up from the box. By filling up all the slots in the board (33, the number of trials per session), subjects could earn an extra dollar for that session. This technique successfully resolved the problem.

Adults

The most common reinforcers used with adult subjects are points or points exchangeable for money. (A survey of the human studies published in the *Journal of the Experimental Analysis of Behavior* shows that up to 1966 points were the most common reinforcer used. After this time, points exchangeable for money have been more frequently employed than points alone.) Generally, the adult subject is seated before a computer monitor or response console; behavior that satisfies response requirements produces points, which are tallied on the monitor or LED counter on the response console. Points seem to be used because of their convenience, not because they are potent reinforcers (although in certain contexts, such as experimental tasks similar to video games, points alone may be very effective reinforcers). Points backed up with money or money alone would seem to be more potent reinforcers than points alone because adult subjects have considerable experience with money as a generalized reinforcer, and because points, per se, have no discriminating or reinforcing function outside the experimental setting.

Although food is by far the most common type of reinforcer used in nonhu-

man animal studies, it is used only infrequently in studies involving adult humans. Food is simply not as convenient as points or money: It is more difficult to store, more difficult to deliver (a special or additional apparatus may be required), and does not always have the reinforcing effectiveness of money. My own experience (WB) with using food as a reinforcer substantiates these statements. In one study, Hal Miller and I were interested in assessing preferences for different snack items using a concurrent operant procedure. Female subjects pulled on one of three doors of a modified vending machine for bite-sized snack items (cupcakes, donuts, and coffee cake that had been sliced into tenths, individually wrapped in cellophane, and placed in the vending machine.) Each door operated according to a different variable-interval schedule. Upon opening the door the subject removed the snack item, unwrapped it, and ate it. Much to our surprise, subjects did not behave according to our expectations: Subjects overwhelmingly preferred the snack item placed on the leanest schedule. During debriefing each subject informed us that she was concerned about keeping her figure slim—a factor that we should have taken into consideration while selecting subjects for this experiment.

In a different study, Miller and I first gave subjects their choice of food reinforcers to be placed behind the vending machine door: chocolate chips, dried fruit, or mixed nuts. Several days after the experiment had begun, I happened to be looking out of a window in the room immediately adjacent to that in which subjects were running, and noticed tiny dark objects falling from the window next door. A casual inspection of the ground below the window revealed an assortment of “reinforcers” scattered about. Suspecting that not all of our subjects threw unwanted food out the window, I looked underneath the vending machine, and found a similar array of discarded goodies. I asked each subject if they were consuming their snack items. In each case, they gave me their word that they were! (To get around this problem, we gave new

subjects strict instructions to consume snack items, bolted the window shut, and inspected under the vending machine after each session. Subjects caught “cheating” were either dismissed from the research or given a warning and a second chance.)

Method of Payment

Some researchers have delivered money, usually coins, to subjects immediately after responding. However, immediate payment does not appear necessary for either maintenance of responding or attendance at experimental sessions as long as there is some immediate consequence of responding. Usually points or other stimuli (lights or tones) are backed up with a prespecified amount of money. The exchange rate of tokens or points for cash is generally specified in the instructions but varies across laboratories depending upon the particular researcher's cash reserve, number of participants, schedule of reinforcement, session duration, etc. At the end of each session subjects are either given a receipt indicating how much they have earned or asked to initial a statement describing specific daily earnings, and they receive a paycheck only at the end of the participation.

ARRANGING EXPERIMENTAL CONTINGENCIES

In addition to programming within-session reinforcement procedures, researchers using human subjects generally arrange other contingencies to (a) attract subjects to the laboratory and (b) ensure that subjects will continue to participate for the necessary number of sessions. The nature of these contingencies varies from laboratory to laboratory, depending upon the resources of the individual researcher.

Extra Course Credit

Many researchers who use college undergraduates as subjects and who either do not use money in their research or who wish to conserve their financial resources often attract subjects into the laboratory

through extra credit. The amount of extra credit that subjects can earn is not dependent upon their performance in the experiment; simply completing each session is sufficient to earn the maximum amount of extra credit offered. In most cases, the use of extra credit as an added incentive for students volunteering to become subjects is effective in terms of both encouraging students to volunteer to participate as subjects in research and in maintaining their attendance at experimental sessions.

The amount of extra credit awarded to subjects for their research participation varies across laboratories. At Auburn University, students are given one-half point of extra credit for every hour of research participation up to ten hours. These extra-credit points are added to their final percentage grade in introductory psychology courses. The problem with this arrangement however, is that not all experimental questions can be satisfactorily addressed in ten research hours. To overcome this problem, researchers sometimes offer cash bonuses to subjects willing to participate in additional sessions (at a rate of \$5.00 to \$7.00 per hour).

Another inconvenience in using extra credit to attract and maintain student subjects concerns timing. Students are more likely to be interested in extra credit after they have received feedback regarding their scores on the first examination in introductory psychology, which may not occur for three to four weeks (or longer) into each academic term. Thus the number of subjects that can be run each term is sometimes limited by the use of extra credit contingencies.

Split Payments

A procedure used by researchers some years ago was to have subjects sign contracts to participate in a minimum number of sessions and to withhold payment if they quit early. Today, such a procedure would not pass most institutional review boards because it would be viewed as penalizing the subject for withdrawing from the experiment. To deal with this

problem, many current researchers use a split payment system. About half the money a subject can earn in the experiment is based on his or her performance on the experimental task. The remainder is paid as a bonus for completing the contracted number of sessions. Thus, sufficient money is paid immediately to put teeth into the programmed contingencies, and the availability of the completion bonus provides an incentive for subjects to complete the experiment. This split payment system has been approved by numerous institutional review boards, and many researchers report that it is a satisfactory solution to the drop-out problem.

A procedure similar to the split payment is a lottery system. Subjects' responding produces a minimal amount of monetary reinforcement, and their continuous attendance in the experiment makes them eligible for a lottery in which one subject wins a cash prize at the end of the experiment. This system encourages subject attendance in the same manner as the split payment system does, but results in substantial saving of money to the researcher since only one subject receives the bonus.

Game-Like Experimental Situations

Many persons who participate as subjects in human operant research report that their experience is uninteresting. After all, sitting alone in a dimly lit cubicle pressing a button on a computer keyboard or other response console every day for a week or two when all that is at stake are points or at best, a few dollars, can hardly be considered exciting. Lack of interest in the experimental task may have some direct effect on how subjects respond during sessions, but its main effect seems to relate to subject drop-out rates. In some cases, researchers must arrange special contingencies beyond extra credit and monetary incentives to ensure that subjects will participate for the experiment's duration.

To make the experimental task more interesting, some researchers have disguised the experimental task as a game

(e.g., Baum, 1975). Embedding experimental questions in creative uses of computer technology modeled after popular video games would seem a viable solution to the boredom problem. Although any repetitious task can become boring sooner or later, the sustained popularity of video arcades and sales of video games for personal computers suggests that experimental tasks resembling video games are likely to maintain subjects' interest over the duration of most human operant experiments. Recent reports published in the *Journal of the Experimental Analysis of Behavior* have not used such technology, so we must await future reports before ultimately judging the utility of such techniques.

CONCLUSION

The choice of reinforcers in research involving human subjects depends partly on the specific research questions that are being addressed. If the study is focused on some aspect of behavior such as matching-to-sample performance, the reinforcer may need only to serve a discriminative function, and almost any stimulus—points, money, etc.—could be adequate for this purpose. However, if the goal of the research is to study the effects of reinforcement on behavior, then choice of reinforcer is not an arbitrary decision. For example, we do not know whether points and points backed up with money differ in terms of their reinforcing effectiveness. Indeed, we have no assurance that these kinds of consequences are indeed responsible for maintaining the behavior of our subjects. Too many other factors are built into the experimental session that may exert control over subjects' behavior in concert with, or instead of, programmed reinforcers. Explicit instructions regarding subjects' behavior relative to experimental contingencies,

extra credit, or cash bonuses for completing the study may modify the effects of programmed reinforcement on responding. In short, a call for parametric analyses of these and related problems seems in order.

When selecting reinforcers and arranging experimental contingencies, we cannot simply follow nonhuman animal laboratory traditions. Unlike most researchers who study nonhuman animal subjects, researchers who study human behavior are not primarily concerned with within-session behavior. They must take into consideration a host of extra-experimental factors that may alter the effectiveness of reinforcing stimuli used within sessions.

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